Contribution ID : **23** Type : **Oral**

The use of variable temperature synchrotron XRD to characterise the behaviour of low temperature solder alloys

Friday, 26 November 2021 16:10 (15)

During the soldering process and the daily operation of the electronic devices, solder alloys experience temperature variation frequently. The mismatch in volume expansion of the solder alloys and the interconnected components can result in stresses which lead to failure. In a solder alloy system with high solubility of one element in another, the effects of thermal expansion and temperature dependent solubility limits are both important contributing factors to the thermally induced volume changes. In this study, Sn-57wt%Bi and Sn-37wt%Bi alloys which are promising materials for low-temperature solders were investigated by in-situ heating synchrotron powder X-ray diffraction (PXRD) to reveal the changes of the lattice parameters of Sn and Bi.
The lattice parameters were derived by the Rietveld refinement of the PXRD patterns using TOPAS Academic V6 and following analyzed by the Coefficient of Thermal Expansion Analysis Suite (CTEAS) package using a tensor method to get the coefficient of the thermal expansion (CTE). Density functional theory (DFT) calculations were adopted to reveal the influence of the solid solution of Bi (or βSn) on the lattice parameters of βSn (or Bi), thereby decoupling the effects of thermal expansion and solid solution of Bi (or βSn) on the thermally induced volume change of βSn (or Bi).

Level of Expertise

Student

Presenter Gender

Man

Pronouns

He/Him

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

Yes

Condition of submission

Yes

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Session Classification : Manufacturing & Engineering

Track Classification : Manufacturing & Engineering